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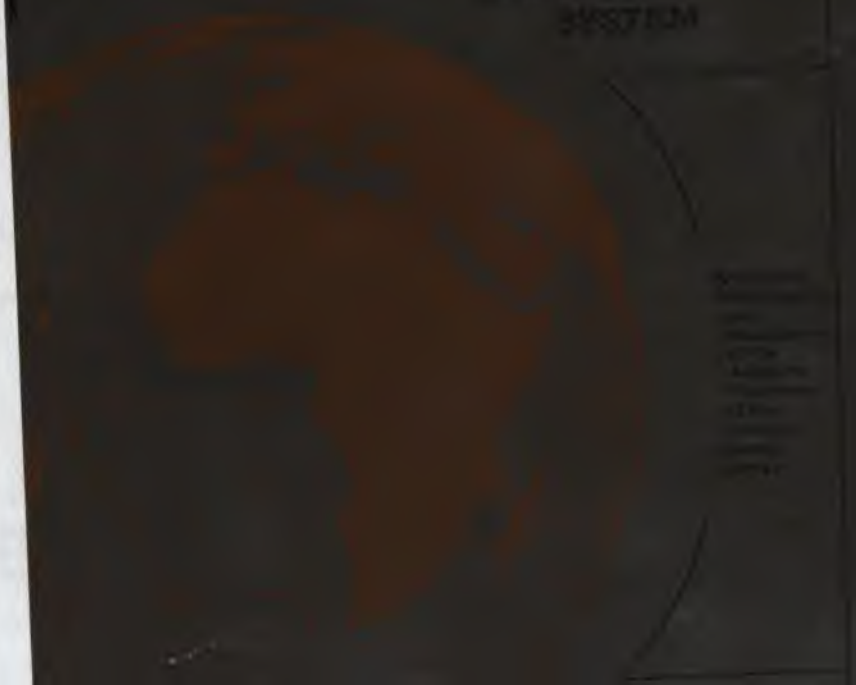
The Tides

and

THE CONTINENT-MAKING FORCES

of the SOLAR SYSTEM



by
JOHN LEOTHOLD

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THEORY IN THE TENTS OF FACT

The author of this essay is in receipt of a letter from the director of the United States Coast and Geodetic Survey, submitting the following observations in criticism of our offering:

1. Your publication entitled "The Tides and the Continent-Making Forces of the Solar System" advances an hypothesis as to the origin of the tide-producing forces. However, no formulæ are given to show any quantitative relationship between the observed times and hights of the tides and the forces postulated. Until such formulæ are developed and the conclusions resulting compared with the tides actually occurring, any tidal hypothesis necessarily remains in the realm of the speculative.

2. It is to be noted that many tidal students regard as no longer tenable the theory of the tides being formed in the waters of the southern Pacific Ocean and propagated east and west around Cape Horn and Cape of Good Hope. The more recent theory regards the tides as being local in their origin.

3. The cotidal map of the world shown on page 19 is also no longer regarded as presenting the correct state of affairs, in-so-far as the time of tide in the wide stretches of the ocean is concerned. A more recent cotidal map is shown in the "Manual of Tides," Part IVB," by Dr. R. A. Harris, a copy of which is being sent you under separate cover.

4. Regarding the tides in the Arctic Ocean, a discussion of which is found on page 31 of your publication, it may be of interest to consult the latest and most informing work devoted to that subject, "Arctic Tides," by Dr. R. A. Harris, a copy of which is sent you together with the "Manual of Tides, Part IVB," under separate cover.

5. So far as the ordinary ocean tides are concerned, the existing difficulties do not relate to the determination of the tidal forces, for these are well known. The difficulties are altogether hydro-dynamical and relate to the motions of existing bodies of water sustained by known tidal forces.

To these observations I rejoin:

1. Mathematical objections to my arguments were by me anticipated in the introductory notes on mathematical physicists. No quantitative formulæ are by me deemed called for in a test of the respective merits of the old theories of tide-production and the new one advanced in this essay. In an argument as to whether the story that Moses by smiting a rock brought forth a stream of water in an arid region is truth or fiction, the size of the current claimed to have been produced is immaterial.

2. Whether tides are formed in the waters of the southern Pacific Ocean and thence propagated east and west is not a fit subject of theory. It must be a matter of fact established by observation. No one has any right to theorize on whether the tides are local in their origin. This, too, must be strictly a matter of observation. If our tidal experts(?) are going to subject the entire matter of tides to theory, both as to place of origin, direction of propagation, and causes, it is of course useless to try to argue with them. I was fully aware that they had been doing this, but I had hoped to show them an incentive for getting back to tidal facts.

I knew what I was doing when I went for my tidal facts back to the scientists of forty, sixty years ago, "who did not allow preconceived theory to distort their vision."

3. The director of the Geodetic Survey is unprepared to say that the cotidal map used in this essay has by actual observations been proven incorrect. I have for some time been in possession of a copy of Mr. Harris' work. I could not use it because in its very preface it admits that it "aims at a system of cotidal lines which, **while conforming to all reliable data, shall reasonably well meet the requirements of the theory alluded to.**" Mr. Harris made himself sole judge of what are "reliable data" and what were the requirements of his theory. Airy's map has been relegated to the rear not by subsequent observations, but by the exigencies of pet theory inconsistent with the facts registered by that map.

The unscrupulous methods of the mathematical physicists are well shown by a paragraph in Prof. G. H. Darwin's work on the tides:

> "Some sixty years ago Whewell, and after him Airy, drew charts illustrative of what has just been described. A map showing the march of the tidal-wave is reproduced from Airy's Tides and Waves. It claims to show, from the observed times of high water at the various parts of the earth, how the tide-wave travels over the oceans. Whewell and Airy were well aware that their map could only be regarded as the roughest approximation to reality. Much has been learned since their days, and the then incomplete state of knowledge hardly permitted them to fully realize how very rough was their approximation to the truth. No more recent attempt has been made to construct such a map, and we must rest satisfied with this one. Even if its lines may in places depart pretty widely from the truth, it presents features of much interest. I do not reproduce the Pacific Ocean, because it is left almost blank, from deficiency of data. Thus, in that part of the world where the tides are most normal, and where the knowledge of them would possess the greatest scientific interest, we are compelled to admit an almost total ignorance."

This is "rich," indeed. In the first place, Professor Darwin prevaricates when he says that he reproduces Airy's map in his book. He admits that he designedly omitted that part of Airy's map relating to the Pacific Ocean, although he also admits that he has nothing to offer in its place, being almost totally ignorant regarding tidal facts in that region.

When it is remembered that, according to Loomis, Airy's map records in that very region a condition most irreconcilable with accepted tidal theory, it is not hard to see why that part of Airy's map has been ostracized.

Professor Darwin also prevaricated when he wrote that the Pacific Ocean had been left almost blank on Airy's map. "Much has been learned since the days of Whewell and Airy," Darwin asserts in one sentence, and "we are compelled to admit an almost total ignorance" in the next sentence. Where is the record of the "much that has been learned"? Why has "no more recent attempt been made" to supplement or perfect the work of Whewell and Airy, in a region where tidal facts would admittedly "possess the greatest scientific interest"? In the face of admitted almost total ignorance, how can Darwin presume to say that in that region "the tides are most normal"? Where does he get this information, except in his imagination?

It is a sorry condition when our scientists become indebted to their imagination for their facts.

There are some regions about the tidal facts of which our scientists do not wish to know anything. They must have some space in which their pet theories may have "undisputed sway," to use one of Darwin's own expressions.

These observations will suffice to show to the reader why I deem it unnecessary to comment on the two remaining points of the Survey director's letter.

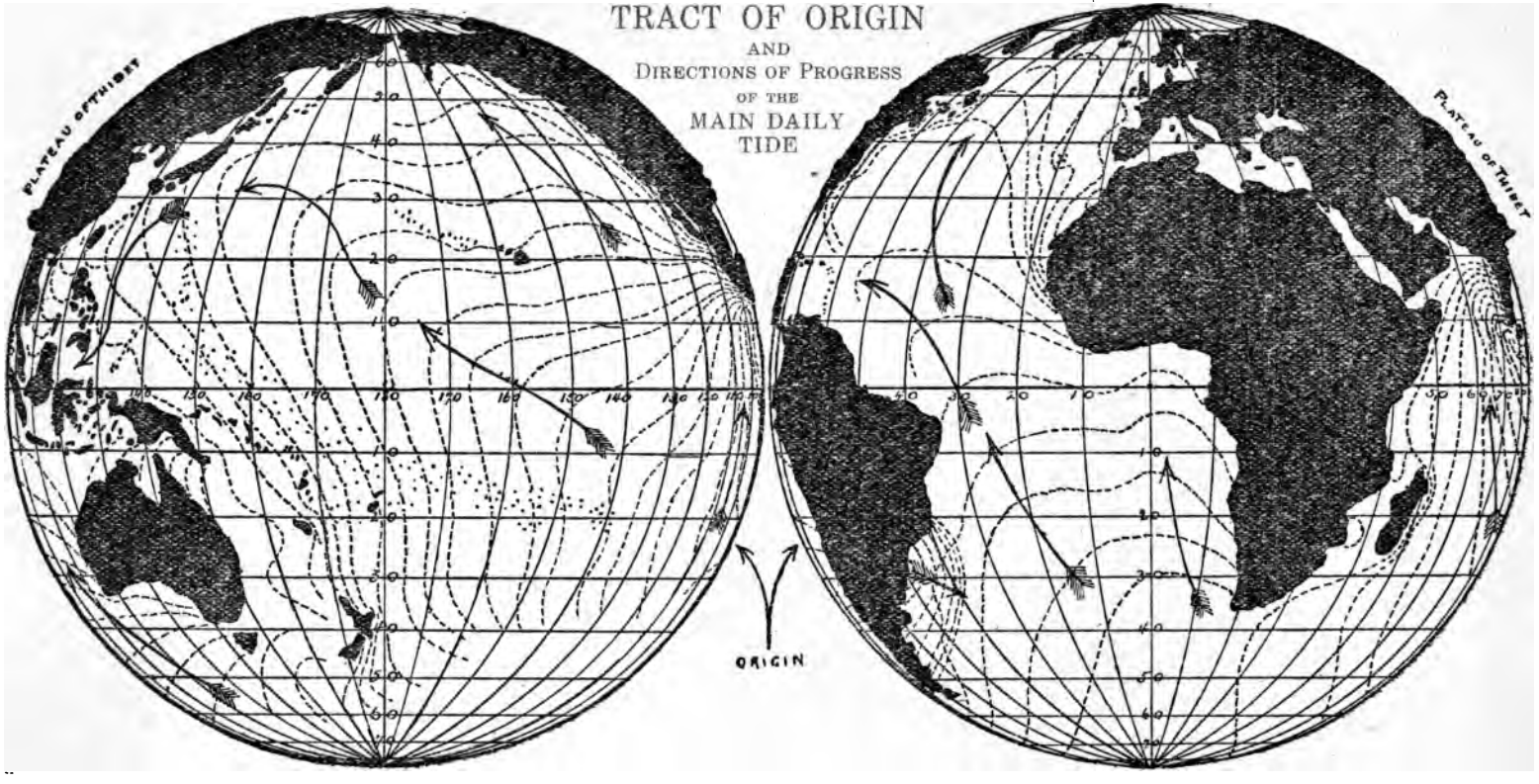
Breckenridge, Colo. JOHN LEUTHOLD.
April 5, 1921.

THE TIDES

AND

THE CONTINENT-MAKING FORCES

OF THE SOLAR SYSTEM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THE TIDES

AND

The Continent-Making Forces of the Solar System

WRITTEN IN CONFIRMATION AND ELUCIDATION OF THE DOCTRINE OF

THE FABRIC OF COSMIC ENERGY

BY

JOHN LEUTHOLD

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PUBLISHED BY THE AUTHOR
AT BRECKENRIDGE, COLORADO, U. S. A.
1921

It is
the function
of science,
not, as some think,
to divest this universe
of its wonder and mystery,
but, as in the case before us, to point
out the wonder and mystery of common things.
The phenomena of matter and force lie
within our intellectual range,
and as far as they reach
we will at all hazards
push our in-
quiries.

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"It was found that the mind of man had the power of penetrating far beyond the boundaries of his five senses; that the things which are seen in the material world depend for their action upon things unseen; in short, that, besides the phenomena which address the senses, there are laws and principles and processes which do not address the senses at all, but which must be, and can be, spiritually discerned. To the subjects which require this discernment belong the phenomena of molecular [?] force. — JOHN TYNDALL.

INTRODUCTORY NOTES

HE days of the "luminiferous ether" theory are numbered; so are the days of that element in the wave-theory of light which is based upon an analogy with the circular undulations produced when an object is dropped upon a placid sheet of water; and so are the days of the theory that the light-propagating force is resident in the atoms from which the light proceeds. With the ether hypothesis will also die the electron theory of electricity and the attraction theory of magnetism and gravitation. The death sentence was pronounced upon the ether theory when for the first time it was said by scientific authority that the space-filling medium has the rigidity of a solid (Lord Kelvin). The sentence has been repeatedly confirmed by similar authority, and very recently by Prof. Hugh Eliot, who says in his book on "Modern Science and Materialism":

"This ether, whatever else it may be, is not matter. The properties which it must possess, if it is to account for the facts for which it was invoked, could not possibly exist together in matter. It must have a rigidity greater than that of steel; it must have a density many million times greater than that of lead; and yet it must be so attenuated that the stars and planets can fly through it at huge velocities without the smallest sign of retardation or friction."

No substance consisting of detached and widely separated particles can qualify for the functions of the space-filling, light-transmitting. gravitation-producing medium. The ether is pictured as an extremely attenuated gas, immeasurably thinner than air. Yet even air fails utterly as a medium for carrying anything in straight paths such as light pursues.

"In air, for instance, at normal temperatures, the molecules are all traveling on the average at about a thousand miles an hour—nearly as fast as a rifle bullet, and faster than the velocity of sound through air. Their motion takes place in all directions; and since they are incessantly colliding with one another, each molecule is constantly changing the direction of its motion. On the average, a molecule moves only three-millionths of an inch before colliding with another; and since their velocity is so great, the average number of collisions for each molecule is about six thousand million a second." (Eliot.)

For the attenuated ether, these figures as to distances and velocities must be multiplied thousands, if not millions, of times. Thus the ether is utterly disqualified for the functions of the space-filling medium.

To these damaging declarations of the physicists Dr. Albert Einstein has added the adverse testimony of higher mathematics.

These developments made the time seem opportune for the publication of the conclusions to which many years of nature-study had led the undersigned in regard to the nature of what Herbert Spencer called "the space-occupying kind of force." That such a force existed had been impressed upon the undersigned both by observation and reason. Consequently, on March 27, 1920, he committed to the columns of his newspaper, The Summit County Star, a brief and general description of the space-filling kind of force as reason had revealed it to him, and he named it The Fabric of Cosmic Energy.

In that article there was expressed the conviction that all space is filled with a densely woven network or fabric of invisible, all-penetrating, continuous and indestructible lines or wires of force, of which the lines of force in a magnetic field are examples made observable by distortion; that the magnetic fields which man creates in shops and laboratories are intensified small fields within immensely larger but weaker fields existing in space; that all magnetic fields, both the natural and the artificial, are strains in or distortions of the Fabric of Cosmic Energy; that the rays or lines of the

INTRODUCTORY NOTES

Fabric of Cosmic Energy have an inherent normal speed equal to that of light in vacuum, which speed is more or less reduced when the rays pass through matter, in which retardation lies the explanation of the force of gravitation; that the rays of the Fabric of Cosmic Energy are the carriers of the vibrations of light, heat, wireless messages and other electrical phenomena; in short, that the Fabric of Cosmic Energy is the seat and source of all energy.

This is, of course, a revolutionary scientific doctrine. Moreover, it is purely physical, and requires a kind of mental vision which perhaps few possess. Scientific thought has so long been directed and dominated by the mathematicians that constructive imagination illuminated by pure reason has become a sadly neglected accomplishment of the human mind, and especially in scholastic circles. The attainments of the mathematicians have been so wonderful and awe-inspiring that the world confidently looked to them for the solution of physical problems also, not realizing that the highly developed mathematical mind is the most untrustworthy in the domain of physics.

The position of scholastic science was fittingly stated by one of its representatives, after perusal of several articles on The Fabric of Cosmic Energy:

"I appreciate your articles greatly. I found them very interesting. But I cannot pass expert judgment on them. My interests lie almost exclusively in the field of pure mathematics."

So far as the mathematical physicists can see, the undersigned has merely substituted one theory for another regarding the space-filling medium, and they say they must withhold judgment pending further elucidation.

The Einstein theory met the same attitude. For fifteen years after Dr. Einstein had propounded his theory, the scientific world remained strangely silent concerning it. Finally, when confirmation of the theory had apparently been supplied by the solar eclipse of May, 1919, (by observations also suggested by Einstein himself), the Royal Society of England "recognized" the Einstein theory, and now nearly every person laying claim to scholarly attainments pretends to be interested in it, and many pretend to comprehend it.

"Seeing is believing." "Except ye see signs and wonders, ye will not believe."

Visual confirmation of a hypothesis must produce faith in it, but faith and comprehension are far from being the same thing. However, where comprehension is unattainable, faith and respectful attention will not be despised.

The Fabric of Cosmic Energy, being absolutely invisible, intangible, like the lines of force of a magnetic field, can only be studied indirectly, by the effects of it.

This essay on the tides and the continent-making forces has been written in elucidation and confirmation of the doctrine of The Fabric of Cosmic Energy. It aims to picture some of the attributes and functions of the lines of the fabric, such as their continuity, elasticity and great tensile strength.

It must be borne in mind that the conception of The Fabric of Cosmic Energy is a bold and novel one. To ascertain the details of its construction and operation will be the work of centuries. To describe the conception either in words or diagrams at this time is pioneer work and quite difficult.

The essay offers an entirely new explanation of tide-production. The offer is made with great confidence, because the explanation is one that can in its main features be verified instrumentally, and the author believes that this verification will soon be forthcoming.

Happily, some forty to sixty years ago the scientific world was blessed with representatives like Whewell, Airy, Proctor and Loomis, who did not allow preconceived theory to distort their vision. To these great men the present writer is indebted for authoritative descriptions of tidal facts. And the explanation here advanced is in perfect agreement with those facts.

The inevitable fall of the present theory of tide-production, upon which so much labor has been bestowed and to which so much profound literature has been devoted, will necessarily shake confidence in many other explanations of natural phenomena formulated by the mathematical physicists. A new day will then have dawned for pure physics and real physicists.

From time to time the undersigned hopes to publish essays offering new views on the mechanism of the atom, on the nature of electricity, on gravitation and magnetism, on the probable mode of production of sunlight, etc., all logical deductions from the doctrine of The Fabric of Cosmic Energy.

Any member of the Illuminating Engineering Society, from whose intelligent interest the author has derived much encouragement, may obtain one copy of this booklet free upon application. Additional copies may be had for $2.00 each.

JOHN LEUTHOLD.

Breckenridge, Colorado, January 1, 1921.

THE TIDES

AND

THE CONTINENT-MAKING FORCES OF THE SOLAR SYSTEM

SEISMIC PRODUCTS OF THE FABRIC OF COSMIC ENERGY

IN the latter part of August of this year (1920), central Chile and a part of western Argentina were visited by a seismic disturbance, said to have been the most violent since the earthquake of 1916, when Valparaiso was partly destroyed, with great loss of life. This disturbance was spoken of as "a happy event from a scientific point of view" by Count Montessus de Balloe, director of the Chilean seismological observatory. Count de Balloe was by the Associated Press credited with the following explanation of his remark:

A happy event from a scientific view-point

"For the last eighteen months there has been complete seismic tranquility, and we know that an undisturbed condition prepares disasters in countries subject to such phenomena. The frequent rumblings correspond to what may be called 'small coin' earthquakes. When no quakes are produced for a long period, the effort is accumulated until it breaks out violently as the forces succeed in crushing the elastic resistance of the terrestrial strata."

The count was further credited with the statement that "Now, according to all probabilities, we will return to a state of normal seismical activity instead of a menacing calm."

"We will return to a state of normal seismical activity!" Count de Balloe says in effect that he lives in a region where "normal seismical activity" is synonymous with almost constant seismical activity. And he does live in such a region. Still, the causes of this condition remain a deep mystery to him, the director of the seismological observatory.

Good region for study of earthquakes

Count de Balloe's reference to "accumulated effort" in connection with Chilean earthquakes calls to mind what the late G. K. Gilbert, of the United States Geological Survey, many years ago wrote on the subject of earthquakes for an encyclopedia:

Where continent-making forces are building a mountain range

"In the descriptive literature of earthquakes there is probably considerable confusion of cause and effect. In connection with an earthquake in 1822 several hundred miles of the coast of Chile were lifted to a height of several feet, and there is reason to believe that portions of the land at a distance from the sea were raised more than those at its border. It was computed that the volume of rock changed from a position below the plane of sea-level to a position above that plane was comparable in magnitude with Mount Ætna, and this stupendous result was supposed to have been caused by the earthquake. As the subject is at present understood, *it appears more reasonable to suppose that the continent-making forces of the earth's crust, whatever their origin may be, tended to elevate that portion of South America, and for a long period had accumulated strains which were opposed by the elasticity and rigidity of the crustal material. When finally the resistance was overpowered by the strains, fractures occurred along certain critical lines, the tract of land rose, the strains were in great part relieved, and an earthquake occurred as an incidental result—a result of supreme importance to the unfortunate inhabitants of that country, but relatively insignificant as a phenomenon of physical geography.*"

By accumulation and relief of strains

Count de Balloe's statement also renders timely a repetition of some sentences from an essay on "The Earthquake in Peru," by Richard A. Proctor, also written many years ago:

"The difference in character between the Peruvian and Chilean earthquakes is a singular and interesting phenomenon. . . . It is said that in Chile a year scarcely ever passes without shocks of earthquake being felt; in certain regions not even a month. A similar persistence of earthquake disturbance characterizes Peru. Yet, although both districts are shaken in this manner, there seems to be a distinct evidence of alternating disturbance as respects the occurrence of great earthquakes. Thus, in 1797, took place the terrible earthquake of Riobamba. Then, thirty years later, a series of great earthquakes shook Chile, *permanently elevating the whole line of coast to the height of several feet.* . . . .

"Darwin relates that near Valparaiso he saw beds of sea-shells belonging to recent species at a height of about a quarter of a mile above the present sea-level, and he concluded that *the land had been raised to this height by a series of such small elevations as were observed to have taken place during the earthquakes of 1822, 1835 and 1837.*"

According to Mr. Gilbert, one Chilean earthquake alone had the "stupendous result" of changing from a position below sea-level to a position above that level a volume of rock comparable in magnitude with Mount Ætna! It must surely be pardonable to take issue with him when he finally declares the event to have been "relatively insignificant as a phenomenon of physical geography."

What is nature of continent-making forces?

"*The continent-making forces of the earth's crust!*" Are not the forces to which Mr. Gilbert, in the scientific light of his day, chose to give this name calculated to awaken the keenest kind of interest and prompt diligent research? Is it not reasonable to expect that a discovery and explanation of these stupendous forces would have a far-reaching influence upon the world's scientific knowledge and probably revolutionize and wonderfully advance much of it?

Discovery not so difficult as it at first appears

The discovery of these forces may not be as difficult as it at first thought appears. To many the true facts may be hidden by a veil of preconceived ideas based upon fallacies and accepted "on faith" from pseudo-scientific literature written by the mathematical physicists who unfortunately have long been permitted to dominate physical science. This veil is getting thinner every day now.

One of the fallacies woven into this veil is that subtle one which insinuates that energy is somehow inherent in matter—an endowment of matter. Physicists have not yet been able to revise their conceptions into agreement with their own dictum that

Continent-making force does not dwell in our globe

"As regards matter, the fundamental property by which it is distinguished is that of inertia. That is to say, if any portion of matter is at rest, it cannot start into motion without the action upon it of some external force; if it is already in motion, it equally cannot alter its velocity or direction of motion without the action of an external force. Resistance to change in its state of rest or of motion is the fundamental property of matter." (Prof. Hugh Eliot, in "Modern Science and Materialism.")

Nor has our globe such a thing as a crust

"The continent-making forces of the earth's crust!" This term was coined when the geologist was contemplating a natural phenomenon for the production of which scientific observation and reasoning had discovered no exterior cause — a land-lifting result in each of a series of Chilean earthquakes. Where earthquakes resulted in the subsidance of land, an exterior force — gravitative pressure — was available and used for explanation; but in the case of land-uplift there occurred a helpless reversion to the unscientific notion that the phenomenon was due to forces dwelling in the earth's crust itself. Were not a connection between the ocean-tides and the moon so obvious that mankind discovered it several thousand years ago, we might in this twentieth century still read about "the tide-producing forces of the waters of the ocean."

A second important aid in the search for the land-lifting force is rendered by the scientific conclusion that there exists no such thing as a crust in the earth's makeup. A number of years ago an article in the Scientific American, commenting on the researches along this line of Prof. T. J. J. See, U. S. navy, said:

Earth is as solid as steel throughout

"By considering the pressure throughout the whole earth, it is found that, even if fluid, our globe would have a rigidity greater than that of wrought iron. The earth's matter under this great pressure acts as a solid, and so vibrates in an earthquake; and the average rigidity of the whole mass is nearly equal to that of nickel steel, such as is used in the armor of a battleship. Nickel steel is one of the strongest and hardest metals known, and it affords us a good idea of the strength and rigidity of the earth. Our globe is thus proved to be capable of withstanding enormous strain; and we need have no fear that earthquakes or volcanic outbursts will ever endanger its stability."

The theory long held by geologists, that the earth is a globe of molten matter inclosed in a thin crust, like the shell of an egg, having

No limit to depth at which we may look for the continent-making forces

at last yielded to more reasonable ideas, we are not restricted, in a search for the continent-making forces, to a depth of but a few miles below the earth's surface. According to Mr. Gilbert, these forces manifest themselves in the production of strains in the earth's mass, which strains are susceptible of accumulation and final collective uplifting action. The theory of the rigidity of the earth permits us to go to the center of the earth, if necessary, in search of these strains and their causes.

Both the forces which raise and those which depress the surface of the earth must be considered to be continent-making forces. But here we are concerned only with those that raise by uplift on a considerable scale. It is admitted by geologists that the latter are comparatively inactive and feeble in the present period of the earth's geological history.

"There may be great terrestrial revolutions which happen so rarely that none has occurred since man began to take note of such things. Among these revolutions of which he has had as yet no experience the most gigantic is the formation of a mountain-chain. That the various mountain-chains of the globe are of very different ages, and that some of the most gigantic of them are, compared with others, of recent date, are facts in the history of the globe . . . ; but so far as human history goes, man has never witnessed the uprise of a range of mountains." (Geikie.)

Chile a promising region for seismological study

This slightly contradicts Geologist Gilbert's statement given above. According to him, there is one region on our globe where man is given opportunity to watch nature in the slow, laborious, groaning task of rearing a mountain-chain. It is a remarkable opportunity, not duplicated anywhere else on the globe. Can this process justly be described as "relatively insignificant as a phenomenon of physical geography"? Does it not rather excite the keenest curiosity of every lover of Nature and of every man who takes delight in tracing the foot-prints of the Creator?

Search for this now operative continent-making force cannot assume an aspect of hopelessness, for the reason that the force operates within a region of limited extent — the narrow southern portion of the South American continent. A close study of this tract of our globe would seem to be quite possible and promise to show peculiar characteristics fit to serve as clues for the solution of the mystery.

Nature produces strains in her workshop as man does in his

As the forces of nature are unfailing, the Chilean earthquake described by Mr. Gilbert was, of course, an inevitable result of the accumulation of strains, and it cannot well be scientific to speak of the earthquake as "an incidental result." From the character and effect of the quake alone can we deduct conclusions concerning the nature and trend of the forces which produced the strains indicated. As the effect of the quake was uplift, the force which produced the strains must have worked in the same direction. Attaining results by means of cumulative strains produced by mallet, hammer or sledge is quite a common procedure in our workshops. In such cases the

taps or blows are always applied judiciously, to make sure that the strains accumulate in the direction of the contemplated breaking-point. The last tap or blow which brings about the desired yielding or break need not be as forceful as its predecessors.

Chilean quakes bid us look for Nature's "taps" in that region

It must be admitted to be reasonable, therefore, to look in the Chilean earthquake region for seismic shocks tending to lift the region, but singly not strong enough to do more than produce strain, and to assume that the final shock which brought on the quake was no more violent or obvious than those which produced the strain. This explains why the violent quakes of that region occur without any "provocation" in the shape of something unsusual being observable in nature.

Necessary element of inequality present in Chilean seismic situation

Under what conditions does inanimate Nature perform work by means of strains? Only where there have somehow been brought about the necessary inequalities. We thus see Nature produce strains in an imperfectly balanced flywheel. Each revolution of such a wheel is accompanied by a "hammer-blow" on the axle or bearings. (In the case of an imperfect wheel rolling swiftly on a rail, the blow is administered to the rail.) If the unbalance is not remedied, an accumulation of strains will result, and this will ultimately find relief in the bursting of the wheel. Where the wheel revolves very slowly, the force of gravitation will cause acceleration of speed when the heavy part approaches the earth, and retardation of speed when the heavy part recedes from the earth. This adjustment to the requirements of gravitative force prevents disturbance; but where rotation is too rapid to permit of acceleration and retardation, trouble occurs; and the faster the rotation, the more violent become the blows.

Almost directly opposite Plateau of Tibet and Himalaya Mountains

If we now examine the Chilean earthquake region geographically, we find it to be almost opposite the greatest protuberance on the surface of this globe, the plateau of Tibet and the Himalaya mountains. The Chilean Andes rise practically from sea-level between the 20th and 40th degrees of southern latitude and in about longitude 70 west; the plateau of Tibet and the Himalayas attain a mean altitude of nearly 20,000 feet, between the 20th and 40th degrees of northern latitude and between the 60th and 100th degrees of longitude east.

Here exists one of those inequalities which Nature must have before she can produce shocks and strains. Here there is a difference of four miles in the length of opposite radii of the earth.

In the moon we have the requisite gravitational factor, and on the part of the earth we have the requisite density, rigidity and speed of rotation, for the production of shock along the line of unbalance.

It may be objected by some that, in proportion to the diameter of the earth, this radial difference of four miles is too small to produce any such effect as is here hinted at. To this I answer that one of the very objects of this brochure is to show how extremely sensitive are the nerves of Nature — the lines or threads of the Fabric of Cosmic

Inequality small; but much more so is its effect

Energy. True, the inequality is comparatively small, and the disturbing gravitational factor is small and remote. But note the extreme smallness of the disturbance. The individual shocks which produce the continent-making strains are so weak that they have so far escaped identification by the seismologists. During hundreds of years the resultant land-lifts have totalled but a few feet.

The demonstrations furnished by gyrostats will serve as answers to the possible objections that what we may observe in a flywheel rotating in fixed bearings cannot apply to a sphere rotating free in space. It is undoubtedly true that the weakness of the earth-shocks is partly due to some instability and flexibility of the earth's axis of rotation.

Inequality greatest in Pacific Ocean about 1,000 miles west of Chile coast

Let it now be objected that, if my contention is correct, then the center of the area of strain and seismic upheaval should be out in the Pacific ocean, some one thousand miles west of the coast of Chile, because that spot and not the Chilean coast is directly opposite the Tibetan protuberance, and there the difference in length of opposing radii is about two miles greater, inasmuch as the Pacific ocean has a depth there of about 10,000 feet.

This objection I am courting, for we have indisputable evidence that the bottom of the Pacific ocean in longitude 90 west and latitude 30 south is subject to the most regular and occasionally to the most violent vertical shocks recorded anywhere on the earth.

Bodies of water best registers of Nature's tide-producing taps

The tremors of the ocean-bottom are here communicated to and revealed by the waters of the ocean. Tidal waves of various sizes invariably accompany the Chilean and Peruvian earthquakes.

A fluid responds more readily to impact than does a solid, rigid substance. An earth-tremor which is imperceptible to any of our senses will visibly disturb a body of water. The qualities of incompressibility, inelasticity and extreme mobility make water very responsive to tremors, shocks and tilts.

"At the time of the Lisbon earthquake, on November 1, 1755, the waters of Loch Lomond were observed to rise and fall every five minutes for nearly two hours, the range of the motion amounting to two feet six inches. Similar motions were noticed in Lochs Katrine and Ness." (Article on Seiches in Nelson's L. L. Encyclopedia.)

Prof. George H. Darwin, in his book on "Tides and Kindred Phenomena in the Solar System," very properly says:

In search for continent-making forces tides must be studied

"Some, and perhaps many, seiches are due to the tilting of the whole lake-bed by minute earthquakes. Modern investigations seem to show that this is a more fertile cause than Forel was disposed to allow, and it would therefore be interesting to see the investigation of seiches repeated with the aid of delicate instruments for the study of earthquakes."

A study of the tidal waves accompanying the earthquakes of Chile and Peru cannot be dispensed with in a search for the continent-

making forces. And for purposes of such study the largest specimen available must serve best.

Greatest Sea-Wave Ever Known the proper one to study

The tidal wave which accompanied the Peruvian earthquake of August 13, 1868, was by Richard A. Proctor, the English astronomer, called "the greatest sea-wave ever known." Fortunately he has transmitted down to us an exhaustive description of it.

"The progress of the great sea-wave which was generated by the upheaval of the Peruvian shores and propagated over the whole of the Pacific ocean differs altogether from any earthquake phenomenon before observed. Other earthquakes have indeed been followed by oceanic disturbances; but these have been accompanied by terrestrial motions, so as to suggest the idea that they had been caused by the motion of the sea-bottom, or of the neighboring land. In no instance has it ever before been known that a well-marked wave of enormous proportions should have been propagated over the largest ocean-tract on our globe, *by an earth-shock whose direct action was limited to a relatively small region, and that region not situated in the center, but on one side of the wide area traversed by the wave.*"

In the course of my argument it will become apparent that tidal waves bearing the characteristics here described, except the size, are the rule and not the exception — that with respect to what Proctor pointed out as a singularity this mammoth wave was typical of the regular tidal waves which daily traverse the oceans.

If Mr. Proctor meant to tell us in the above sentences that the motions of the Peruvian shores and not of the sea-bottom produced the huge wave, then he contradicted himself later on. In the course of his essay he wrote:

Originated in antipodes of Tibetan Plateau

"The northerly shore-wave seems to have been more considerable; and a moment's study of a chart of the two Americas will show that this circumstance is highly significant. When we remember that the principal effects of the land-shock were experienced within the angle which the Peruvian Andes form with the long north-and-south line of the Chilean and Bolivian Andes, we see at once that, had the center of the subterranean action been near the scene where the most destructive effects were perceived, no sea-wave, or but a small one, could have been sent toward the shores of North America. The projecting shores of northern Peru and Ecuador could not have failed to divert the sea-wave toward the west; and though a reflected wave might have reached California, it would only have been after a considerable interval of time and with dimensions much less than those which traveled southward. When we see that, on the contrary, a wave of even greater proportions traveled toward the shores of North America, we seem forced to the conclusion that *the center of the subterranean action must have been so far to the west that the sea-wave generated by it had a free course to the shores of California.*"

If the center of the subterranean action was in a southwesterly direction from the shore-angle referred to, a path is opened for a wave toward the Californian coast without going very far to the west. As will be shown later on, there is strong reason for the belief that said center was near longitude 90 west and latitude 30 south — the tract directly opposite the Tibetan plateau.

Professor Proctor's essay furnishes further proof that the center of subterranean action was out in the Pacific ocean:

To produce the wave, water had to be first withdrawn from a vast area of ocean

"At Arica the sea-wave produced even more destructive effects than had been caused by the earthquake. *About twenty minutes after the first earth-shock, the sea was seen to retire*, as if about to leave the shores wholly dry; but presently its waters returned with tremendous force. A mighty wave, whose length seemed immeasurable, was seen advancing like a dark wall upon the unfortunate town, a large part of which was overwhelmed by it."

"At Callao a yet more singular instance was afforded of the effect which circumstances may have upon the motion of the sea after a great earthquake has disturbed it. In former earthquakes Callao had suffered terribly from the effects of the great sea-wave. . . . But upon this occasion the center of subterranean disturbance must have been so situated that . . . . , although *the water retreated strangely from the coast near Callao*, insomuch that a wide tract of the sea-bottom was uncovered, there was no inrushing wave comparable with those described above. . . . . Six hours after the occurrence of the earth-shock . . . . three considerable waves rolled in upon the town. But clearly these waves must not be compared with those which in other instances had made their appearance within half an hour of the earth-throes."

Even Australia had to furnish its quota

"At about half-past three on the morning of August 14th, *the water began to retreat in a singular manner from the port of Littleton*, on the eastern shores of the southernmost of the New Zealand islands. At length the whole port was left entirely dry, and so remained for about twenty minutes."

Figure 1 depicts the cause of a withdrawal of water from parts of the ocean.

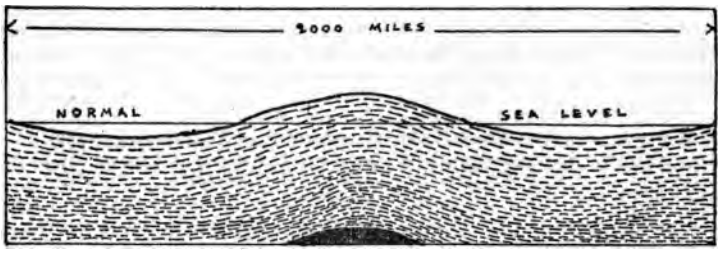


FIG. 1

The retirement of the sea as long as nine hours after the shock indicates a tremendous drawing-together and piling-up of the water of the ocean somewhere. And the fact that the retirement took place within twenty minutes after the shock on the coast of Chile and nine hours after the shock at New Zealand indicates that the center of the shock was proportionately much nearer to the Chilean coast than to New Zealand — so near to the former, in fact, that, because of its proximity, most of the elevated water had to be drawn from the west.

The east-bound wave which rolled in upon some of the Peruvian and Chilean coast-towns is described as having been fifty feet high, and the west-bound wave as having been from 200 to 1,000 miles wide and its length to have extended from one side to the other of the great ocean. The height of the west-bound wave in mid-ocean was indeterminable; but its vast other dimensions represented an enormous volume of water. As far away as the coast of California, the wave is said to have been sixty feet high.

Wave the result of a lifting-up of water by vertical seismic shock attended by relief of strain

Such a wave must have come from the region where the upheaving continent-making forces are at work of which Mr. Gilbert wrote. It must have been the result of one of those upheavals which periodically relieve an accumulation of earth-strains. Perhaps its tract of origin — "a relatively small region . . . on one side of the wide area traversed by the wave" marks the region where the strain-producing hammer-blows of the continent-making forces do their best work. It may be possible to discern evidences there of these tappings of Nature.

Since the cumulative effect of the blows or throes is a gigantic tidal wave, why should not the single blows or throes produce small tidal waves?

In same tract we may look for high water raised by Nature's strain-producing "taps"

Tidal waves there are on the oceans, plenty of them. Observation has, however, determined that there are two main daily tides. These tides having been platted and described by conscientious scientists who loved facts more than theory, we are enabled to study them closely.

Figure 2 is a reproduction of a map of cotidal lines found in Guyot's Physical Geography. The same map was used by Prof. Simon Newcomb in connection with his writings on the tides. It was first drawn, I believe, by Sir George Airy, an eminent English astronomer.

On this map, lines are drawn connecting all those places which are reached by a given wave at the same hour of absolute time. The cotidal lines are drawn at intervals of one hour. The arrows are inserted by the writer, to visualize conditions hitherto either ignored or explained away.

We will let Prof. Elias Loomis, erstwhile of Yale college, who used a skeleton of this map in his Treatise on Astronomy, tell us what the map reveals:

Maps of cotidal lines show that the main daily tide originates in this tract

"By inspecting the map, we perceive that *the great tidal wave originates in the Pacific ocean, not far from the western coast of South America*, in which region high water occurs about two hours after the moon has passed the meridian."

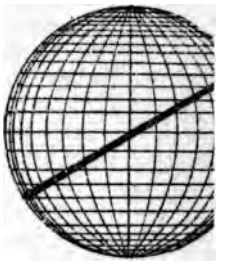
"*The wave of high water, first raised near the western coast of South America*, travels toward the northwest through the deep water of the Pacific at the rate of 850 miles per hour."

"The tidal wave which we have thus traced through oceans, bays and rivers has every variety of direction; in some places advancing westward, and in others eastward; in some places northward, and in others southward; but in each case it may be regarded as a continuous forward movement, and the change in its direction results from a change in the direction of the channel. *But there is one exception to*

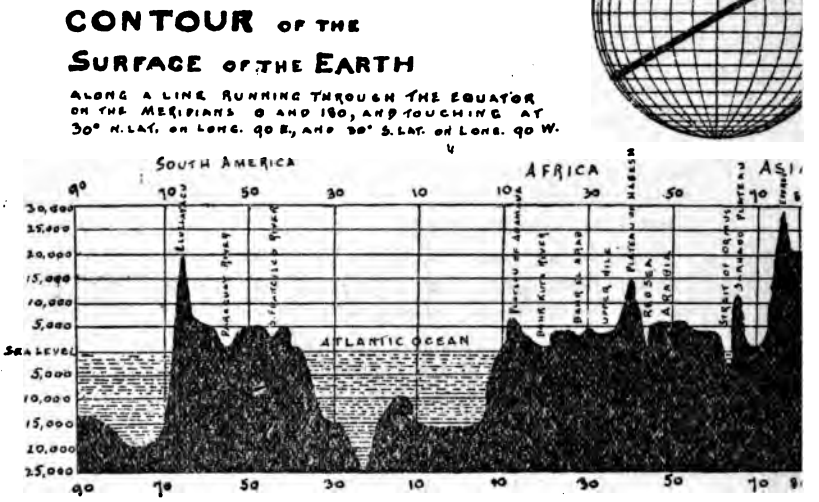
Testimony of Prof. Elias Loomis

this general rule. We have traced the origin of the tidal wave to a region about 1,000 miles west of the coast of South America. From this point high water is not only propagated westward around the globe, but also eastward toward Cape Horn. In this region the motion of the tidal wave appears to be similar to that of the wave produced by throwing a stone upon the surface of a tranquil lake, the wave traveling off in all directions from the first point of disturbance."

The regular daily tides have their origin in the Pacific ocean about 1,000 miles west of the coast of South America. This fact was established and published by scientists into whose theories it did not fit at all, which is proof of the obviousness and undeniability of their findings.



In this tract of origin we behold, not a wave, but high water — a lifting of the water above the normal



level. This phenomenon is repeated every day, about two hours after the moon has passed the meridian.

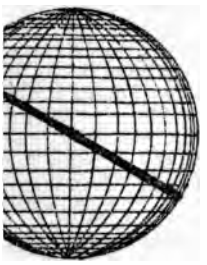
High water two hours after the moon has crossed the meridian

Every day, about two hours after the moon has passed over the center of the tract, an earth-shock is here communicated to the water of the ocean and lifts it above the normal level. Here, directly opposite the Tibetan plateau, there is enacted daily a small-scale repetition of the occurrence which produced, fifty-two years ago, in exactly the same area, what Proctor called "the greatest sea-wave ever known," and 183 years ago (October 6, 1737) what Nelson's Encyclopedia speaks of as "the greatest sea-wave on record."

The map records several other things which assume great significance when the true cause of tide-production is recognized, but which have hitherto been ignored.

For instance, the map shows that not only is a wave propagated eastward to and slightly beyond Cape Horn, but a small wave starts away from the coast of southern Argentina. This wave does not go far, however. Together with the wave which comes eastward and rounds Cape Horn, it is soon merged with a wave which, after a forty-eight hours' journey almost around the world, reaches Cape Horn from the South Atlantic ocean. Here, every day, the oldest of three tidal waves which for several hours are on the oceans at the same time dies in the arms of the youngest wave.

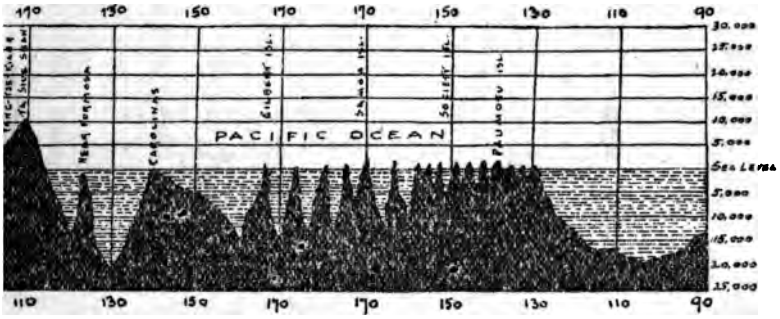
Small wave goes east from coast of southern Argentina



Short-lived though it may be, the wave which comes out of Saint George's Bay, in southern Argentina, proclaims that an earth-tremor has crossed that narrow portion of South America from the west or northwest.

IT CONSTITUTES AN INVITATION TO THE SCIENTIFIC WORLD TO BRING THEIR "DELICATE INSTRUMENTS FOR THE STUDY OF EARTHQUAKES" AND OBTAIN THE AUTO-

Nature here beckons to seismologists



GRAPHS OF THE TIDE-PRODUCING, CONTINENT-MAKING FORCES OF THE UNIVERSE.

In the current literature on earthquakes there are found many statements which encourage the belief that the scientific world will deem reasonable the request that the suggested seismological observations in the region of tide-origin be made. Writing on earthquakes for Nelson's Encyclopedia, one authority says:

Science now within sight of the truth

"A daily periodicity has been made out; but there is no clear evidence that the moon has any influence upon the occurrence of earthquakes. Since earthquakes must be due to an instability in the earth's crust, it is reasonable to expect this instability to be influenced by tide-producing forces such as might result from the moon's gravitation action."

Movements of "Greatest Wave"

Professor Proctor's description of the great sea-wave shows that in its general movements this wave conformed to the movements of the diurnal tides as charted on the map (Fig. 2):

pictured movements of daily wave

"In somewhat less than three hours after the occurrence of the earthquake, the ocean-wave inundated the port of Coquimbo, on the Chilean seaboard, some 800 miles from Arica. An hour or so later it had reached Constitucion, 450 miles farther south; and here for some three hours the sea rose and fell with strange violence. Farther south, along the shore of Chile, even to the island of Chiloe, the shore-wave traveled, though *with continually diminishing force.* . . .

"*The northerly shore-wave seems to have been more considerable.* . . . . There can be no doubt that the wave which swept the shores of Southern California, rising upward of sixty feet above the ordinary sea-level, was absolutely the most imposing of all the indirect effects of the great earthquake. When we consider that even in San Pedro Bay, *fully 5,000 miles from the center of disturbance, a wave twice the height of an ordinary house rolled in with unspeakable violence only a few hours after the occurrence of the earth-throe,* we are most strikingly impressed with the tremendous energy of the earth's movement. . . . .

"At Yokohama, in Japan, *more than 10,500 miles from Arica, an enormous wave poured in on August 14th,* but at what hour we have no satisfactory record. So far as distance is concerned, this wave affords most surprising evidence of the stupendous nature of the disturbance to which the waters of the Pacific Ocean had been subjected. The whole circumference of the earth is but 25,000 miles, so that this wave had traveled over a distance considerably greater than two-fifths of the earth's circumference. . . . . ."

North and northwest tendency of wave very pronounced

It is evident from this description, which could be quoted more extensively to the same effect, that the westward and northwestward progress of this wave was far more rapid, and carried a far greater volume of water, than its eastward and southeastward progress.

In the course of his essay, Professor Proctor ventured the opinion "that if the surface of the earth were all sea, waves setting out in opposite directions from the center of disturbance would have met each other at the antipodes of their starting-point." The above citations from the essay argue conclusively against such an inference. They show that the wave required nearly three hours to reach the Chilean coast at Coquimbo, and four hours to reach that coast at Constitucion, both of which places were situated but a few hundred miles east and southeast from the eastern edge of the tract of high water created by the earthquake. And notwithstanding the admitted extreme proximity of the Peruvian and Chilean seaboards to the focus of the seismic disturbance, no wave exceeding fifty feet in height is recorded to have reached either seaboard. The wave traveled toward Cape Horn "with continually diminishing force," and there is no record of its having gone any distance to the east of that cape. In its northwestward journey, on the other hand, the wave carried sixty feet of water to the distant shores of Southern California, and arrived in Japan, 10,500 miles away, within less than twenty-four (probably

less than twelve) hours. The great sea-wave of October 6, 1737, which originated in the same tract, is said to have broken near Cape Lopatka, at the southern end of Kamchatka, 210 feet in height, yet it left no record of extreme size or violence on the east of the tract of origin.

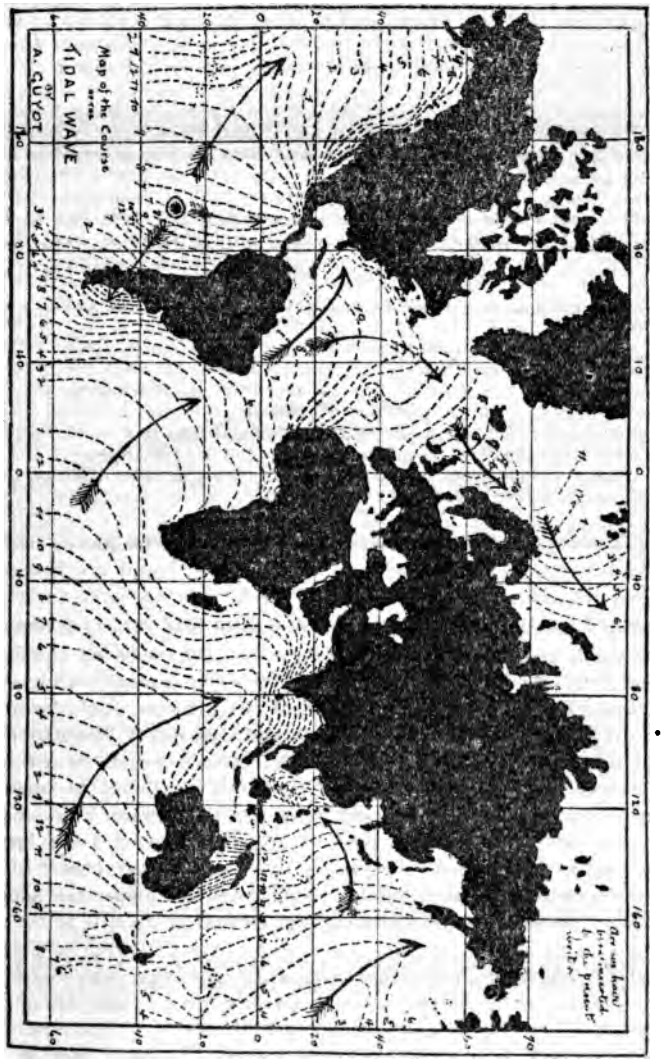


FIG. 2

Airy' map of cotidal lines

On a smaller scale, these are the characteristics of the regular daily tidal waves. Says Professor Loomis :

"The wave of high water, first raised near the western coast of South America, travels toward the northwest through the deep water of the Pacific at the rate of 850 miles per hour, and in about ten hours reaches the coast of Kamchatka. On account of more shallow water, the same wave travels westward and southwestward with less velocity, and it is about twelve hours old when it reaches New Zealand, having advanced at the rate of about 400 miles per hour. Passing south of Australia, the tidal wave travels westward and northward into the Indian Ocean, and is twenty-nine hours old when it reaches the Cape of Good Hope."

Causes of westerly and northwesterly rush of the wave

The enormously preponderating northwestward rush of every tidal wave which originates in the tract described is the composite result of two causes.

The cause of the westward tendency is illustrated by Fig. 3. Being raised above the normal sea-level, the elevated body of water cannot keep up with the earth's rotation, which on the equator has a speed

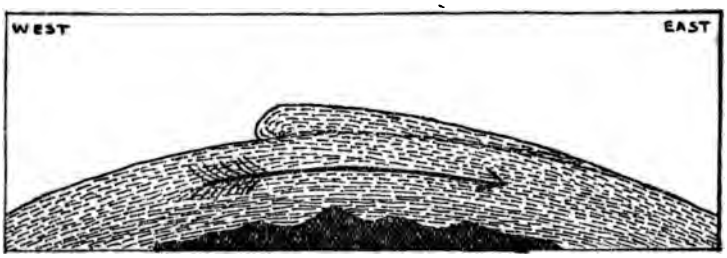


FIG. 3

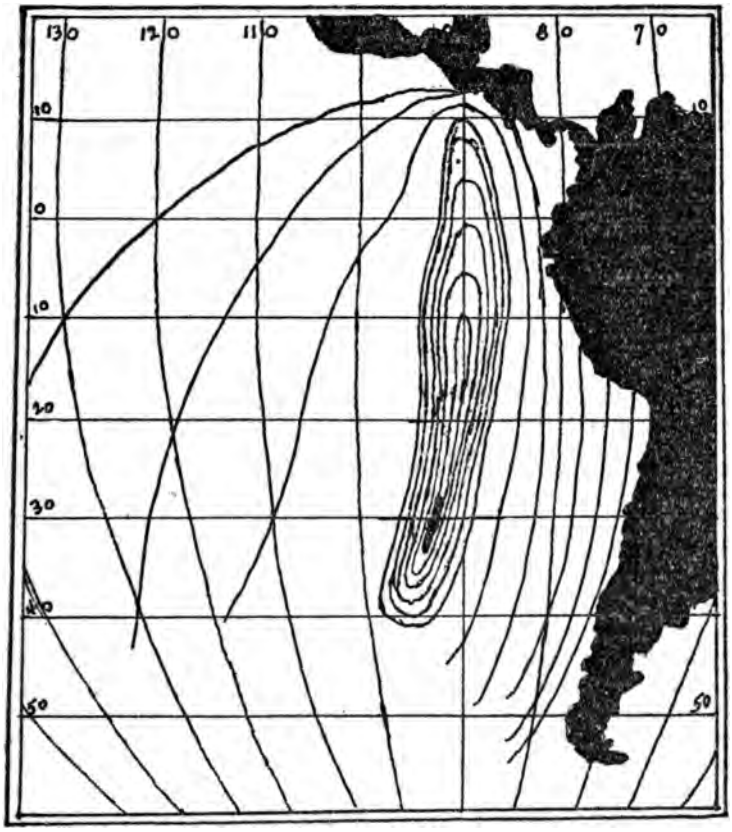
of about 1,000 miles per hour and in latitudes 30 a speed of about 650 miles per hour, and is from west to east. This inability to continue eastward with the main body of water gives the elevated body of water the character of a westward-moving wave. For a comparatively short distance, a portion of the elevated water is carried eastward by the momentum which it had before it was thrown up. That its westward movement nowhere fully equals the eastward movement of the main body of water is due to the friction incident to the opposite movements of the two bodies of water. This friction is greater over shallow water than over deep water, and it is therefore over shallow water especially that the wave assumes the shape pictured in Fig. 3. To again quote from Proctor's essay:

Something moves in opposite direction underneath

"The eminent physicist Mallet speaks thus (we follow Lyell's quotation) about the waves which traverse an open sea: 'The great sea-wave, advancing at the rate of several miles in a minute, consists, in the deep ocean, of a long, low swell of enormous volume, having an equal slope before and behind, and that so gentle that it might pass under a ship without being noticed. But when it reaches the edge of soundings, its front slope becomes short and steep, while its rear slope is long and gentle'."

That the wave which passes south of New Zealand and Australia has a speed of only 400 miles per hour is not due to shallowness of the ocean, but to the fact that in that latitude the speed of the earth's motion from west to east is less than 500 miles per hour.

Were it not for the earth's rapid rotation, there would be no vertical earth-shocks and consequently no tidal waves; but if a tract of high water could be produced on an ocean of a non-rotating,



Strong northward trend of high water from tract of uplift

FIG. 4

perfectly symmetrical earth, then, and then only, would the elevated water flow off evenly in all directions. It is safe to say, however, that the resultant wave would nowhere attain anything like the speed displayed by the tidal waves on the rotating earth.

The pronounced northerly tendency of the tidal wave is due to the fact that the southern hemisphere is considerably lighter than the

Due to lesser weight of southern hemisphere

northern, and the earth's axis is consequently less stable in the southern hemisphere than in the northern. The tide-producing earth-throes, arising, as will be shown later, from a violent shifting of the earth's center (or centers) of gravity, disturb the earth's axis, but the southern half of the axis responds to the shocks much more readily than the northern half. This tends to throw northward the water which is lifted up when the shock reaches the surface of the solid portion of the earth.

How pronounced this northward thrust is may be learned from Fig. 4. The tract of high water from which the tidal wave proceeds has never been observed as circular. It assumes an oblong shape at once, extending north from the point of origin.

Northerly trend very persistent

The map of cotidal lines (Fig. 2) shows the northward trend of the tidal wave to be very persistent. That portion of it which at first is forced by circumstances to travel southwestward and pass New Zealand and Australia to the south turns sharply northward as soon as opportunity offers, a part of it making for the point of the peninsula of India and most of the remainder turning into the Atlantic Ocean, stopping in its northward march only when compelled to by the icy barriers of the Arctic regions.

Tide-producing shock due to violent shifting of earth's center of gravity

As said before, the tidal wave is the product of vertical waves in the solid earth due to a violent shifting of the earth's center of gravity. Professor Loomis tells us that high water occurs in the tract of tide origin two hours after the moon has passed the meridian; in other words, two hours after the moon was over the center of the tract of tide-origin and directly opposite the Tibetan plateau. As the behavior of the tidal wave testifies to a disturbance of the earth's axis of rotation incident to the shifting of the center of gravity, the tide-producing earth-tremors must be produced in or near that axis and proceed thence to the surface of the globe. The radii of the earth are approximately 4,000 miles in length, and vertical seismic waves have, according to Humboldt, a speed of about thirty miles per minute. The tide-producing earth-waves do therefore require nearly two hours to travel from the center of the earth to its surface (and my theory may help to ascertain what the speed of vertical seismic waves really is). The shift of the center of gravity must, to agree with my doctrine of the Fabric of Cosmic Energy, occur immediately after the center of gravity, which lies outside of the axis of rotation in the direction of the Tibetan protuberance, has reached its maximum distance from the moon; in other words, immediately after the center of the moon has crossed the meridian of the center of the tract of tide origin. Two hours later the water rises.

Seismic waves require two hours to travel from center of gravity to surface

A violent shifting of the center of gravity and tilting of the axis of the earth, such as tide-production and the earthquakes which from

time to time accompany them demonstrate, calls for a coupling between the earth and the moon far more substantial and tenacious than any which an extremely rarefied gas could furnish, such as the ether is pictured to be. Prof. Charles R. Gibson argued better than he knew when he wrote, in "Wireless Telegraphy and Telephony":

Coupling between earth and moon is very tenacious

"There must be some substantial coupling between the earth and the moon. We see the moon making continual monthly journeys around the earth, and a simple calculation tells us that her speed is about fifty miles per minute. Her natural tendency is to move in a straight line, and it requires a gigantic force to pull such a huge mass of matter away from its normally straight path. We know that the gravitative pull of the earth keeps the moon tethered. Sir Oliver Lodge has calculated what material thing would be required to tether the moon to the earth, and having arrived at a great array of figures, he puts the result into the following picture: 'The force with which the moon is held in its orbit would be great enough to tear asunder a steel rod four hundred miles thick, with a tenacity of thirty tons per square inch; so that if the moon and earth were connected by steel instead of gravity, a forest of pillars would be necessary to whirl the system once a month round their common center of gravity."

No space-filling medium which consists of detached and widely separated particles of matter can supply this coupling. Continuity and tenacity, in addition to great quantity, must be characteristics of the medium of gravitation.

Attraction theory doomed

There are two forces in the universe which are very similar in their operation—so similar, in fact, that it is sometimes difficult to determine to which of them observed effects should be ascribed. These forces are gravitation and magnetism. Erroneously in the case of both, the manner of their operation is being called attraction.***

* As calling attention to the vagueness of the boundary between gravitation and magnetism, the following is quoted from an appendix to R. A. Proctor's "Saturn and Its System":

"The planetary system presents certain points of uniformity for which the law of gravity does not account; thus: — The planets revolve in the same direction around the sun, in orbits nearly circular, and nearly in one plane; they also rotate on their axes, and their satellites (excepting those of Uranus, and possibly Neptune's satellite) revolve, in the same direction; all the known asteroids revolve in the same direction. That this uniformity is not the effect of chance will appear from a single example: The probability that the 83 known asteroids, if projected in the same plane but otherwise at random, should all revolve in one direction, is less than 1 in 4,835,700,000,000,000,000,000,000."

** Because it is unreasonable and inconceivable, even Sir Isaac Newton took care to disavow unqualified endorsement of the attraction-theory of gravitation. In his treatise on "Optics," Newton wrote:

"How these attractions [of gravity, magnetism and electricity] may be performed, I do not here consider. What I call attraction may be performed by impulse or by some other means unknown to me. I use that word here to signify only in a general way any force by which bodies tend toward each other, whatever be the cause."

Thomas H. Huxley said in one of his magazine articles:

"Anyone who will look into the 'Principia,' or the 'Optics,' or the 'Letters to Bentley,' will see, even if he has no more special knowledge of the topics discussed than I have, that Newton over and over again insisted that he had nothing to do with gravitation as a physical cause, and that, when he used the terms attraction, force and the like, he employed them, as he says, 'mathematice,' and not 'physice.' . . . . According to my reading of the best authorities upon the history of science, Newton discovered neither gravitation nor the laws of gravitation; nor did he pretend to offer more than a conjecture as to the causation of gravitation. Moreover, his assertion that the notion of a body acting where it is not is one that no competent thinker could entertain, is antagonistic to the whole current conception of attractive and repulsive forces and therefore of 'the attractive force of gravitation'."

Gravity, magnetism and electricity closely related

It is a part of the doctrine of the Fabric of Cosmic Energy that gravitation, magnetism and electricity are but different manifestations of the same agency—a dense fabric of lines traveling in closed paths of immeasurable extent at a normal speed of 186,000 miles per second.

These rays or lines of force are retarded in the course of their passage through a body of matter. The amount of resistance offered their passage depends upon the atomic structure of the body and determines the specific gravity of the body. The rays emerge from a material body with less speed and force than they possessed when they entered the body. Between two material bodies close together there is therefore less dynamic force than in the rest of the fabric of force, and the faster and more dynamic rays of free space tend to drive the bodies together. This is the force of gravitation, which affects all material objects impartially. All of the Newtonian laws of gravitation are applicable to it.

Strains in Fabric of Cosmic Energy

Magnetism and electricity are special and more intense strains in the network of lines of force. They, however, need not be considered here. Suffice it to say that all three of the fabric's manifestations owe their irresistible power to the enormous inherent speed of the rays or threads and to the fact that, while the threads may be distorted, twisted and strained, their continuity cannot be broken nor their progress altogether arrested. While attempts to do so are giving us the benefit of electric light and power, the operation involves a well known element of danger.

In a body of uniform average density or symmetrically varying density, the lines of force reach their individual maximum retardation in the center of their paths through the body. The solid portion of the earth, for instance, may be considered a body of symmetrically varying density; that is, while its density is greatest in the geometrical center of mass, the density decreases uniformly in all directions toward the surface. The rays of the fabric penetrate the earth in every conceivable direction,* forming chords of every conceivable length. The longer the chords, the greater the retardation; therefore, the larger and denser the body, the stronger the force of gravitation.

Center of Gravity a physical fact

THE CENTER OF GRAVITY OF A BODY IS THAT POINT IN WHICH THOSE RAYS OF THE FABRIC OF COSMIC ENERGY INTERSECT WHICH TAKE THE LONGEST PATHS THROUGH THE BODY AND EXPERIENCE MAXIMUM AND EQUAL RETARDATION IN THAT POINT.

* The rays of the Fabric pass through material bodies in deflected, tortuous paths, but for the purposes of the present argument they may be regarded as straight lines. The fact that they are retarded in their passage through matter is of supreme importance here. And this fact has been established experimentally by means of light-bearing rays passing through transparent and semi-transparent matter. See Charles R. Gibson's "Scientific Ideas of Today," page 102.

Center of gravity in non-symmetrical body

In a geometrically perfect sphere of symmetrical density, remote from possible exterior gravitational influences, the center of gravity lies in the center of figure; but any irregularity of shape or density, or proximity to another object, will necessarily draw the center of gravity out of the center of figure. The lines of force which enter a sphere like the earth by way of a protuberance like the plateau of Tibet attain the maximum of retardation before they reach the center of figure. If now there is a depression in the figure of the earth directly opposite the protuberance, the lines which enter the earth by way of that depression must pass still farther beyond the center of figure before their degree of retardation balances that of the lines coming from the direction of the protuberance.

Lines of the fabric which pass from one material body to a neighboring one enter the second body already more or less retarded, and reach the maximum of retardation sooner than those coming from clear fields. This moves the center of gravity in the direction of the neighboring body. The moon (and in a lesser degree the sun) would draw the earth's center of gravity out of the axis of rotation even if the center of gravity were not thus moved by the earth's own irregularity of shape.

Influence of moon on earth's center of gravity

When the lines of force entering a body do so by way of both a neighboring body and a protuberance, the maximum of their retardation is hastened still more, and the center of gravity goes farther than ever to meet them. Thus, when the Tibetan plateau is directly under the moon, the earth's center of gravity is moved abnormally far in the direction of the plateau. And it naturally follows that, when the moon and the plateau are on opposite sides of the earth, conditions are radically changed, and the center of gravity is not under full command of the plateau, but seeks to draw away from it toward the moon. This desire is intensified by the fact that, when the plateau is opposite the moon, a deep ocean-bed is under the moon.

When a wheel or sphere whose center of gravity, because of some deformity, lies without the axis, rotates within the field of gravitative influence of another body, the center of gravity of such wheel or sphere constantly changes its position with reference to the axis or center of figure; and in a sphere, unless the disturbing body is directly over the equator, the center of gravity must also constantly change its position with reference to the equatorial plane.

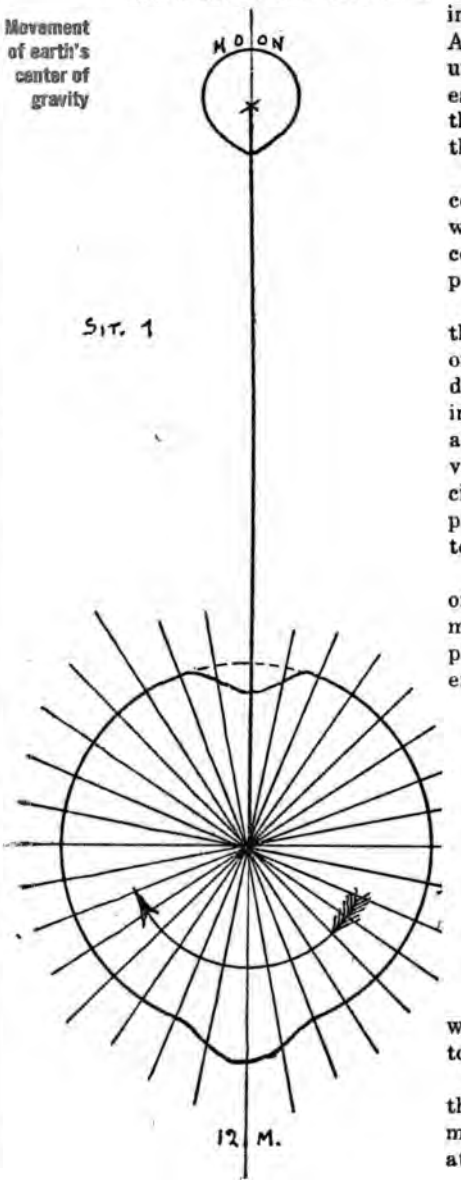
Rapid rotation causes violent disturbance

As said once before, where the rotation is slow, the body can adjust itself in a quiet way to the movements of the center of gravity by alternating accelleration and retardation of the speed of rotation. In rapid rotation the adjustment is accomplished violently at a certain point in each revolution.

I have endeavored, with the means at my command, to picture my conception of the movement of the earth's center of gravity during a revolution, and the moment of violent readjustment, in diagrams

representing five situations. Except the first and the last, which are almost simultaneous, the situations are six hours apart.

Sit. 1 shows the location of the center of gravity of the earth immediately after the readjustment. As the result of a compromise, figuratively speaking, between the earth's deformity and the moon, the center of gravity must be nearer the axis than at any other time.



Sit. 2 shows the location of the center of gravity six hours later, when the deformity's pull on the center of gravity is not only unopposed, but aided, by the moon.

Sit. 3 shows a further removal of the center of gravity from the center of figure, due to the fact that the deformity and the moon co-operate in pulling it away. It is quite probable that my drawing is too conservative, and that under the favorable circumstances the center of gravity proceeds much farther from the center of figure.

Sit. 4 shows a still greater removal of the center of gravity, due to the momentum it had gained in its easy progress to Sit. 3. The moon's influence is now opposed to, but not yet strong enough to overcome, the effect of the earth's rapid rotation. To say that a center of gravity acquires momentum may startle by its novelty, but it is one of the facts disclosed by a study of the Fabric of Cosmic Energy.

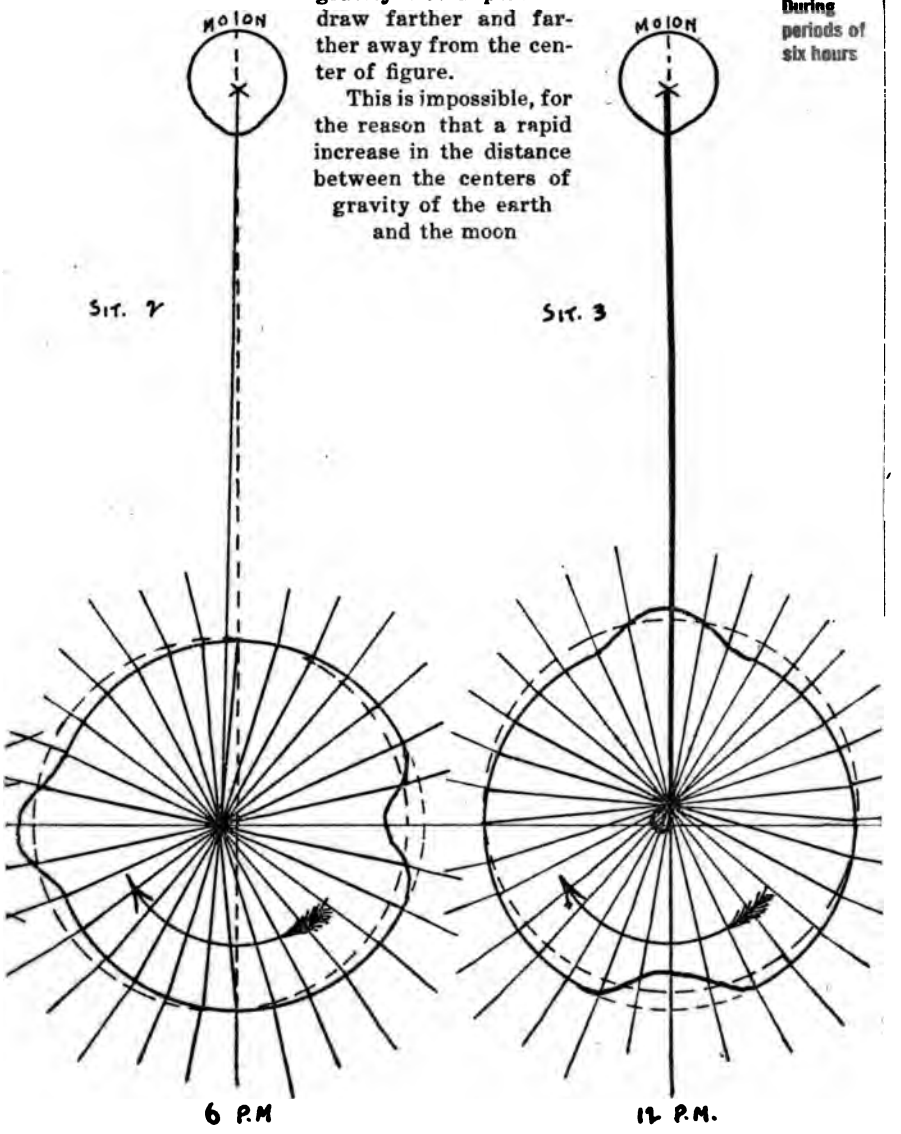
Sit. 5 shows the time of violent shifting of the center of gravity to the position shown in Sit. 1, and indicates the seismic waves which the event produces and sends toward the surface of the earth.

The drawings aim to demonstrate that the earth's center of gravity must, under the alternately co-operating and counteracting influences of

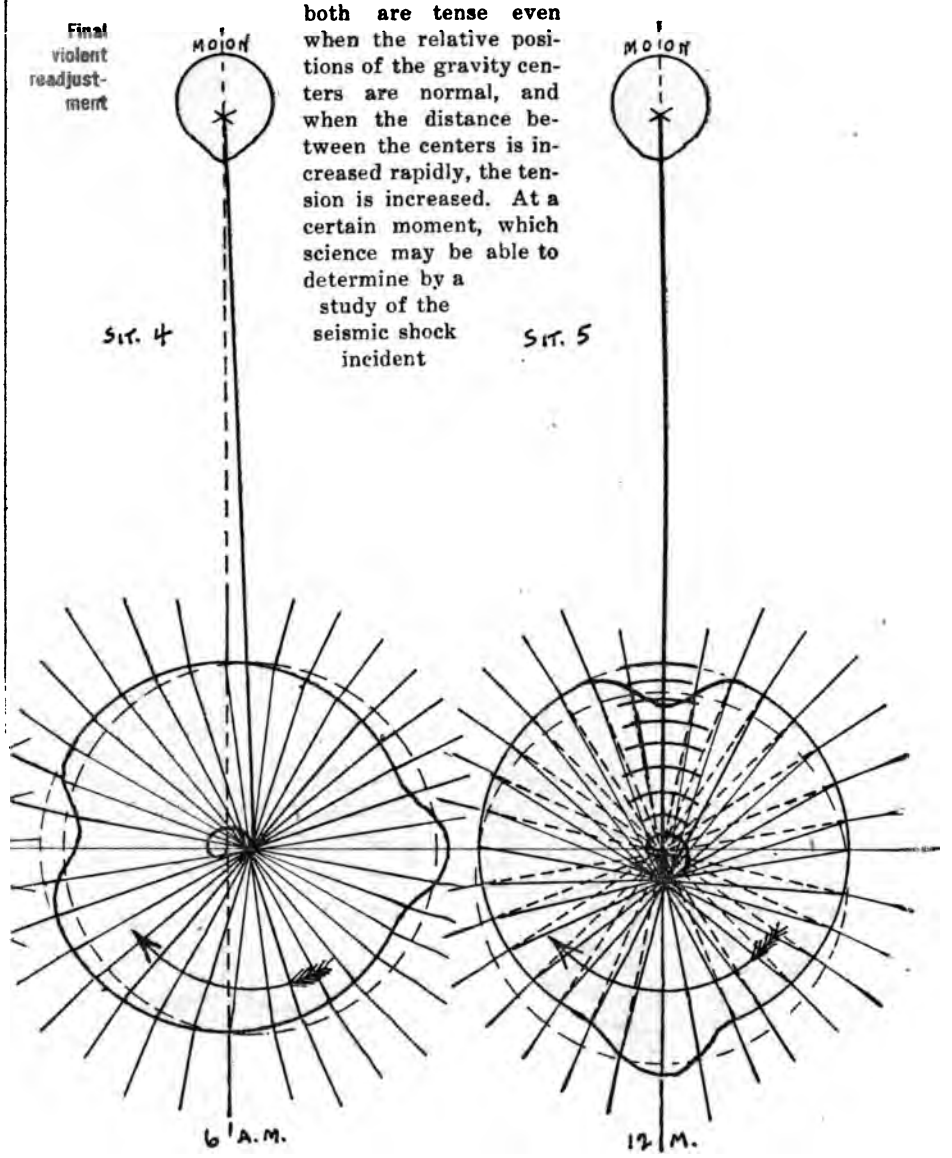
the terrestrial deformity and the nearness of the moon, describe a parabolic or spiral path around the center of figure. If this condition were not annulled at a certain stage of every revolution, the center of gravity would perforce draw farther and farther away from the center of figure.

This is impossible, for the reason that a rapid increase in the distance between the centers of gravity of the earth and the moon

During periods of six hours



(Sits. 4 and 5) results in a stretching of the lines of force running in opposite directions through both. Because of the degree of retardation in each center of gravity, the lines of energy running through both are tense even when the relative positions of the gravity centers are normal, and when the distance between the centers is increased rapidly, the tension is increased. At a certain moment, which science may be able to determine by a study of the seismic shock incident



thereto, this tension is released and the moon wins a compromise from the deformity of the earth.

Lines of force are all of one family

This proves the kinship of the lines of the Fabric of Cosmic Energy to the magnetic lines of force which special conditions can bring into the direct and controlled service of humanity. By subjecting them to various degrees of tension, we make magnetic lines of force perform work for us. Science will ultimately glory in the great discovery that the Ruler of the Universe performs all His wondrous works by the same agency.

Oscillation of center of gravity

It cannot be thought that the earth's center of gravity, when suddenly shifted, promptly finds the point of equilibrium. Like the center of gravity of any other body which experiences a violent displacement, it will first go beyond the point of equilibrium, and thus set up a seismic vibration in the opposite direction toward the plateau. In this manner a minor tidal wave is daily generated in the Indian Ocean, forming the lesser of the semi-diurnal tides.

This explains how the great sea-wave of 1837, which originated in the South Pacific Ocean, came to coincide with an earthquake in India, and why on the day when this was being put in type (December 20, 1920) press dispatches reported severe earthquakes both in the Chile-Argentine Andes and in the desert of Gobi, in central Asia.

May be studied in cases of collision

The oscillatory movements of violently displaced centers of gravity may be studied in any collision between rapidly moving heavy bodies, such as railroad cars. When the colliding bodies are brought to a sudden standstill, their centers of gravity (the lines of force which intersect there) continues on aways, until the lines of force have acquired sufficient tension to balance the momentum. During these seconds of time the collided bodies press against each other forcefully. When the momentum has been overcome, the centers of gravity, with their lines of force, return rapidly to their normal positions, only to be carried beyond these positions by the new momentum acquired. The collided bodies not only cease their pressing, but, with squeaks and groans, often manage to draw slightly apart. As the centers of gravity perform another oscillation, the bodies come together once more. Finally they come to a state of rest with a vibratory motion suggesting a shudder, responsive to the short and quick oscillations of their centers of gravity across their respective points of equilibrium.

Moon also a deformed body

The moon is also a deformed body. There probably was a time when the moon rotated oftener than once a month, so that its center of gravity did not always lie toward the earth. If so, the tug-of-war between the two centers of gravity must have been still more strenuous, the continent-changing forces on both bodies more active and powerful, and the resultant tides much higher and more frequent. Evidently the moon has lost out in the contest, and its center of gravity is under complete control of the earth's center of gravity.

The moon's diurnal libration in longitude is not hap-hazard, but in strict obedience to the conditions pictured in Sits. 2 and 4.

Spring and Neap Tides

What is being taught under the old theory of tide-production concerning the relation of "spring tides" and "neap tides" to the relative position of the earth, moon and sun holds true for this new theory.

When the moon is in quadrature, the lines of force operating between the sun and earth counteract in a measure the lines of force operating between the moon and the earth, and alter the movement of the earth's center of gravity in a way that leaves less play, in Sit. 5, for the shifting of the earth's center of gravity. The resultant vibrations are weaker and the tidal waves lower.

When the sun and moon are on the same side of the earth, the process pictured in the five situations is intensified, and high [redacted] tides are the result.

Higher tides being the result of more pronounced seismic waves, there must be greater danger of the vibrations releasing accumulated strain and producing earthquakes when the sun and moon are in conjunction than at other times, especially in the South Pacific region.

Quakes most frequent at syzygies

When the sun and moon are on opposite sides of the earth, the lines of force operating between the sun and the earth tend to aggravate the oscillations of the earth's center of gravity which follow the shifting, and to make the seismic waves traveling toward the Indian Ocean stronger, and the semi-diurnal tides more equal in size. Hence, when the sun and moon are in opposition, there is also more than average danger of earthquake, especially in India and adjacent parts of Asia.

In Guyot's "Physical Geography" is found the following statement corroborative of my contentions:

> "Perrey, by comparing 7,000 observations, found the number of earthquakes occurring at the syzygies—when the attraction of the sun and moon is combined and the moon is nearest the earth—greater than at the time of their quadratures, when the moon is most distant; also that, during an earthquake, the shocks are more frequent where the moon is on the meridian."

Secondary centers of gravity

With a view to simplifying this exposition, I have proceeded as if our globe had but one protuberance and but one depression, directly opposite each other. The fact is, however, that the earth has numerous other, though lesser, deformities. These minor deformities, as they enter into varying relations to the moon and the sun, cause varying retardation of the lines of force passing through them and the extra-terrestrial bodies. Because of the ever-changing relations due to the earth's rapid rotation, the lines of force passing through the earth's deformities and the extra-terrestrial bodies cannot all attain equal maximum retardation in one point of intersection or center of gravity, but must form secondary centers of gravity. These secondary centers must perforce independently go through all the

situations pictured for the main center, with the same effects. Many minor tides observed on the oceans find their only explanation in this fact. To cite one typical case:

In an essay on "The Secret of the North Pole," Richard A. Proctor wrote:

"But a circumstance was noticed respecting this sea [an open sea lying to the northeast of Kennedy Channel] which was very significant. The tides ebbed and flowed in it. . . . . The narrow straits between Greenland on the one side and Ellesmere Land and Grinnell Land on the other are completely ice-bound. We cannot suppose that the tidal wave could have found its way beneath such a barrier as this. 'I apprehend,' says Captain Maury, 'that the tidal wave from the Atlantic can no more pass under this icy barrier, to be propagated in the seas beyond, than the vibrations of a musical string can pass with its notes a fret on which the musician has placed his finger.' Are we to suppose, then, that the tidal waves were formed in the very sea in which they were seen by Kane and Hayes? This is Captain Maury's opinion. 'These tides,' says he, 'must have been born in that cold sea, having their cradle about the North Pole'." **Also produce tides**

Between the South Pole and the North Pole there exists an inequality of terrestrial radii similar to that between Tibet and the South Pacific Ocean, the South Pole being situated on a high plateau rising abruptly out of the Antarctic Ocean, and the North Pole in an extensive ocean of unascertained depth. **North and South Poles in unequal altitudes**

As to conditions at the South Pole, Nelson's Encyclopedia says, in describing Captain Amundson's discovery of that Pole:

"On November 11 land was sighted dead ahead, and on November 17 the ascent between the mighty peaks of South Victoria Land began — some of the way climbing glaciers so steep that twenty dogs were required to pull the loads. The first night camp was pitched at 2,000 feet altitude; the second at twice that; and on the fourth day later, having covered seventeen nautical miles and ascended 5,600 feet, camp was made at an altitude of 10,600 feet. Through a heavily glaciated, mountainous country, peaks appeared at levels of from 9,000 to 15,000 feet, the highest being Neilson Mountain. Over the 'Devil's Dancing Room' the party reached the greatest height, 10,750 feet, on December 6. . . . . *The Pole was located upon a vast white, snow-covered plain, slightly descending to the south, and at an elevation of about 10,750 feet.*"

Describing the Arctic Ocean, the same work says:

"Apparently there is no land in the higher latitudes, and *the [North] Pole is in a vast sea of comparatively smooth ice.*" **Tide born in Arctic Ocean**

Captain Maury was right. The tides of the Arctic Ocean "have their cradle about the North Pole."

Several pages could be devoted to showing that other minor tides are similarly related to deformities in the earth's shape, but the size planned for this booklet forbids it.

It should not be necessary to point out that this essay does not say that, because the vibrations which produce the tides come from

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Strain-release may not be at great depth

near the center of the earth, the earthquakes periodically resulting from these vibrations also reach that depth. Just as there is no telling where an unbalanced flywheel will crack and break if subjected to the shock-strains too long, so is there no predicting at what depth in the earth the accumulated seismic strains may produce earthquake. The depth undoubtedly varies greatly. The vaster the extent of an earthquake, the deeper go undoubtedly its roots. Probably less than a hundred miles from the earth's surface, the pressure, density and rigidity are so great that no yielding or fracturing is possible, and the tide-generating vibrations are there undulations pure and simple.

Near the beginning of this essay, appeal was made to the conclusion already arrived at by science that the earth is rigid throughout. It must now be apparent that, if the crust or egg-shell theory still governed, this argument would show a practical and sure way of refuting it.

Earth throbs with seismic pulses

When Geologist Gilbert spoke of "the continent-making forces of the earth's crust," he referred to the land-lifting forces, for which science had no explanation. To explain these is the primary object of this essay. As there can no considerable uplift occur anywhere in the surface of the earth without a compensating drop elsewhere, this essay indirectly explains many other earthquakes. If the booklet succeeds in arousing enough interest to induce seismologists to test its statements with their instruments, it will be found that the earth throbs with rhythmic heart-beats due to law-governed adjustments of the lines or wires of cosmic energy during their laborious passage through its mass, which heart-beats produce not only all true tides, but more or less directly all the earthquake and volcanic phenomena.

Continent-making force resides in space

In the term "continent-making forces of the earth's crust" lurks more than one error. In addition to harboring the egg-shell fallacy, it succors the more subtle fallacy that matter can set itself in motion by its own boot-straps. *The explanation of tide and earthquake phenomena advanced by this essay place the active energy in space — outside of the aggregations of matter involved. The essay teaches that the energy dwells in the invisible, intangible, and yet all-penetrating and all-powerful rays or lines of the Fabric of Cosmic Energy. There is strictly complied with the scientific axiom that "resistance to change in its state of rest or of motion is the fundamental property of matter."*

False theory veils facts; true theory reveals them

The first few paragraphs of this essay call attention to the fact that, with nothing but the current fallacious theories to work with, a man may live in the constant presence of certain natural phenomena, and even be engaged in the study and recording of them, and yet remain utterly blind to their causes and functions. On the other hand, *with the aid of truth arrived at by pure reasoning, a man residing far away from an opportunity to personally observe the phenomena, and having but a general knowledge of them derived from books, may be enabled to recognize those causes and functions.*

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